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AVIAN HAZARDS TO THE AIR FORCE ROCKET SLED TEST TRACT, HOLLOMAN AIR FORCE BASE, NEW MEXICO

Rutherford C. Wooten, et al

Air Force Weapons Laboratory
Kirtland Air Force Base, New Mexico

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AIR FORCE WEAPONS LABORATORY
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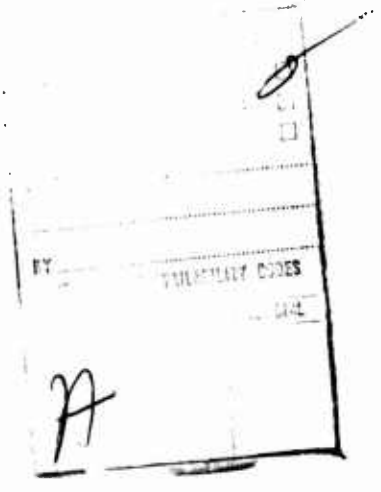

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(Distribution Limitation Statement A)

Bird-rocket sled collisions at the rocket-sled test track at Holloman AFB, New Mexico, have resulted in severe damage to rocket sleds and ancillary equipment. The ecotonal location of the track, together with abundant water supplies created by the water-braking system and an artificial rain field, is instrumental in attracting a large avifaunal population. Of the 41 species observed in the test track vicinity, house finches, horned larks, lark buntings, loggerhead shrikes, scaled quail, mourning doves and western meadowlarks are most abundant. The bird population is greatest in autumn due predominantly to an influx of migratory horned larks. Techniques which may effectively reduce the incidence of birds in the test track vicinity include habitat manipulation designed to reduce sunflowers and other herbs and seeds on which local birds feed; the reduction of standing water in the test track braking channel; and the establishment of alternate food and water sources away from the test track. The three or four covies of scaled and Gambels quail can probably be captured with ground traps and transplanted. The broadcasting of actual or simulated bird alarm vocalizations were effective in dispersing horned larks and house finches and should be applied just before a sled launch.

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FOREWORD

This research was performed under Program Element 63723F, Project 683M3E08.

Inclusive dates of research were 23 January 1970 through 10 June 1972. The report was submitted 12 December 1972 by the Air Force Weapons Laboratory Project Officer, Lt Michael J. Boulter (DEE).

The authors wish to thank Phillip H. Powers, Sergeant, USAF, for his assistance in gathering field data.

This technical report has been reviewed and is approved.

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SECTION I

INTRODUCTION

The Air Force rocket sled test track at Holloman AFB, New Mexico, is a 7-mile parallel track that has been used for testing rocket engines for more than 15 years. Rocket sleds traveling at very high speeds along the track have been damaged or destroyed by collisions with birds. Bird control measures used in the past--without notable success--include carbide cannons, gun crews with shotguns, and a "bird-catcher" rocket sled designed to clear the track just before the launching of a test sled. The bird-catcher sled, although one of the most successful of all techniques attempted, has several shortcomings. An interval of several seconds must elapse between the firing of the bird-catcher and the test vehicle to ensure that the first vehicle will not be overrun by the second. Even though this interval is small, a few birds may perch on the track after the bird-catcher has passed but before the launch of the test sled. In addition, the operation of a bird-catcher sled is very expensive.

The most recent and effective bird-control technique is the ignition of a low, one-load detonating fuse (Primacord) alongside the rail approximately 1 to 2 seconds before a test sled launch. Limitations of this method include the interference of the Primacord's smoke and debris with camera coverage, and the danger of Primacord debris landing on the track and inflicting structural damage to the sled. The cost of Primacord usage can range between $600 and $1,000 per month and requires careful, time-consuming installation. Primacords and bird-catcher sleds currently cost the test track facility more than $33,000 annually (bird-catcher sleds, including manhours, $20,173.50, and Primacord, including manhours, $13,691.75). Because of the susceptibility of test sleds to bird collisions, many high-velocity sleds are launched at night when bird activity around the track is minimal. This creates the additional expense of overtime pay for civilian track personnel.

The importance of bird control around the test track can be illustrated by noting that collision with a single small bird by a sled traveling 3000 to 7000 ft/sec can totally destroy the test vehicle. Sleds traveling at the rate of 5800 ft/sec collide with birds with sufficient force to pierce 1-1/2 inches of the armor plate and completely destroy valuable recording equipment. Damage

from a bird-sled collision can exceed $50,000 for a high-performance test. The average bird-collision damage figure is about half this amount.

The Air Force Weapons Laboratory has conducted applied research into the bird control problem at Holloman with the objective of obtaining 100 percent control of birds in the track vicinity for the few seconds necessary for a high-velocity sled to travel the track's 7-mile course.

SECTION II

ENVIRONMENTAL SETTING

1. LOCATION

The track is situated approximately 20 miles west of Alamogordo, New Mexico, at the western edge of the White Sands National Monument. The track is located on the fringe of the last zone of vegetation before the beginning of desert waste. Such zones of transition between two biotic communities are known as "ecotones" and often support fauna found in each community. Hence, ecotones typically support fauna in unusual diversity and abundance. The unique ecotonal location of the test track area accounts, in part, for its relatively high incidence and variety of animal life (see figure 1).

2. WATER

Water used in the braking system of test vehicles is probably the track's most significant bird attractant. As shown in figure 2, a channel is constructed between the rails of the track. Before sled ignition, that portion of the channel at which deceleration should begin is filled with water. When the vehicle reaches the water-filled area, a scoop on its underside carries water up and forward 180 degrees, resulting in a tremendous braking action. Following a sled-launch, water is retained in the channel for many hours before it is finally drained away or evaporated, thus creating a source of water for birds.

The braking action of the test sleds also forces water out of the channel. This water contributes to the growth of vegetation along the borders of the track. This vegetation provides food and cover for many species of birds. One particularly luxuriant area is east and west of the pump house where the low area known as Hay Draw intersects the track. Also contributing to the relatively lush vegetation in Hay Draw is a sprinkler system ("artificial rain field") that is used to test the effects of rain erosion on high-velocity test vehicles. Water from this system floods Hay Draw each time a rain erosion test is conducted. The water leaking from the rain field's pipes and valves keeps the area continually moist. Seventeen leaks in the pipes on the inside of the channel provide a permanent water supply.

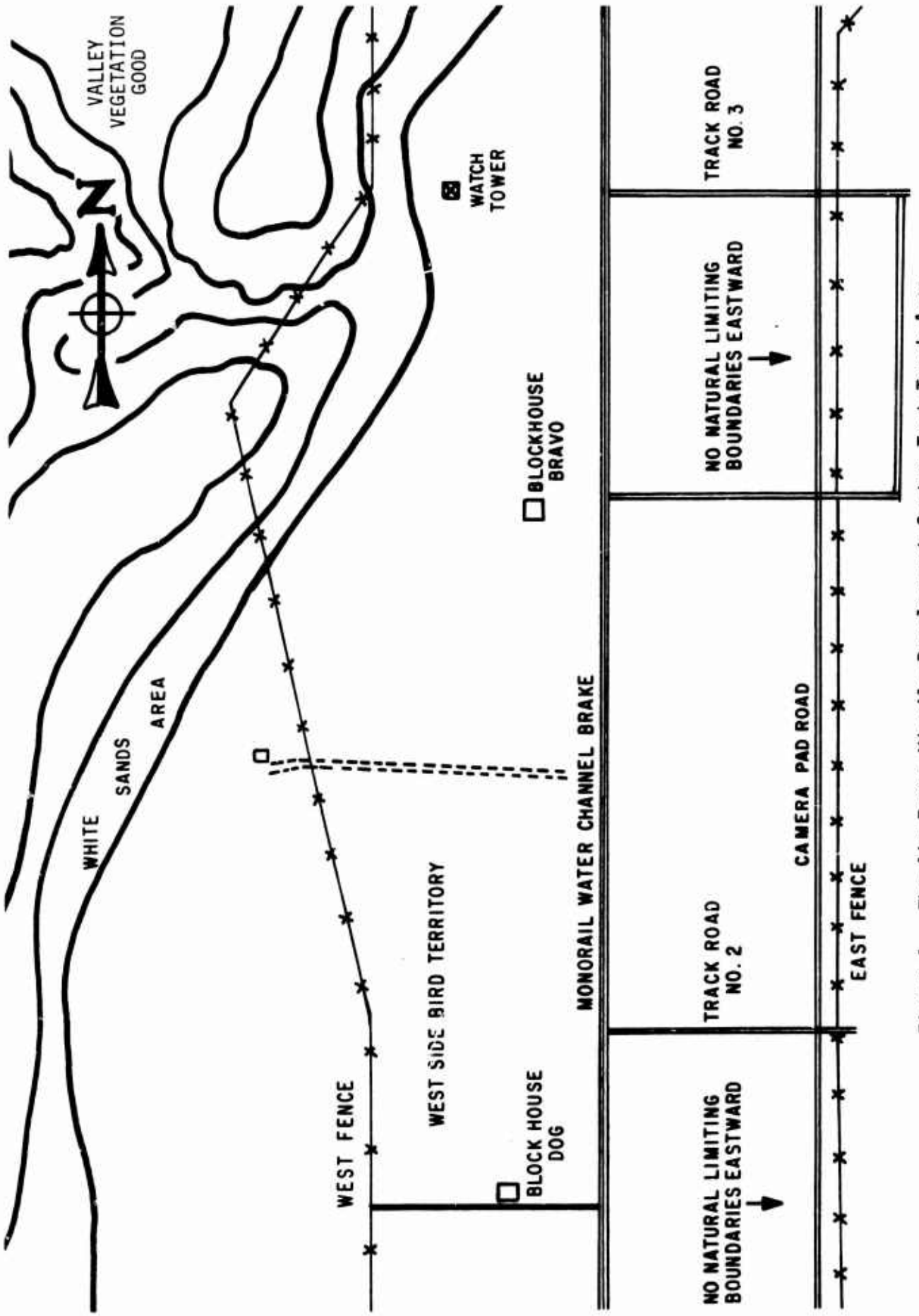

Figure 1. The Air Force Missile Development Center Test Track Area

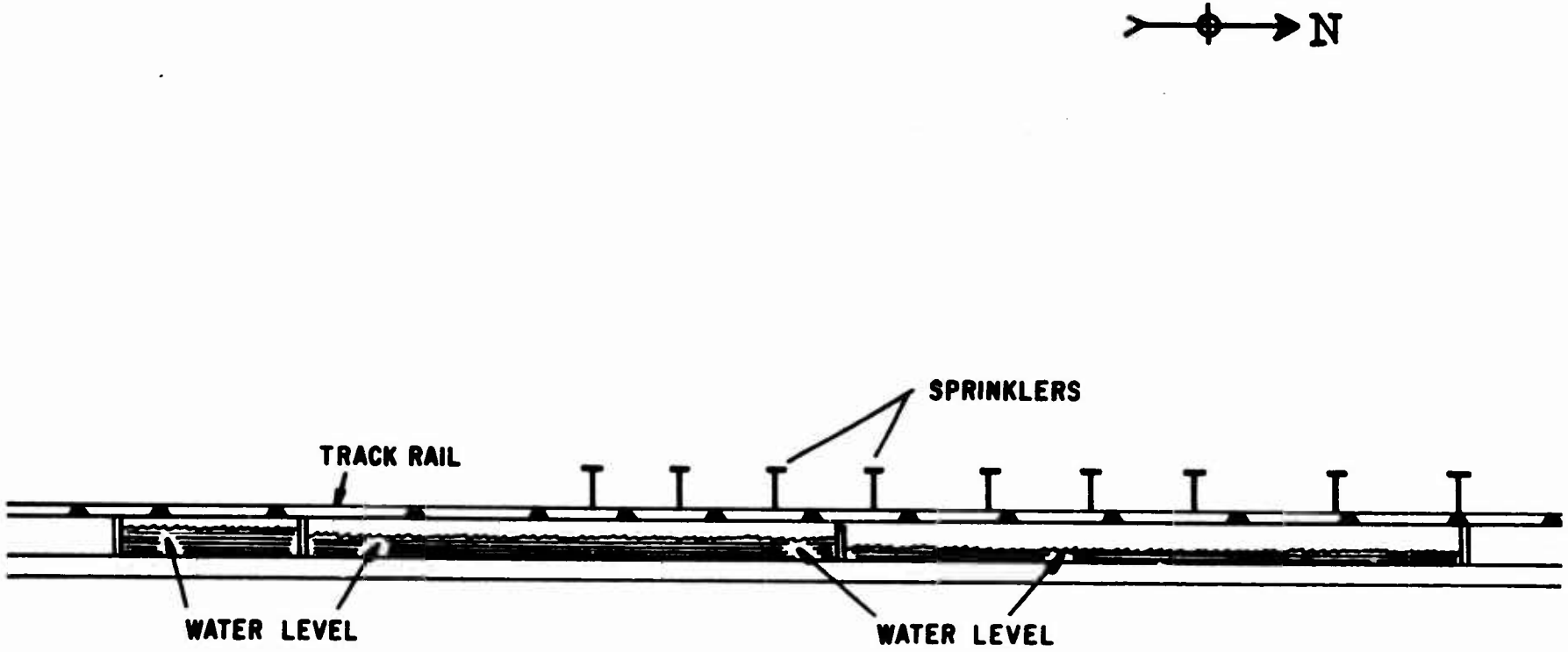

Figure 2. Longitudinal Section of the Test Track Showing Water-Braking Channel

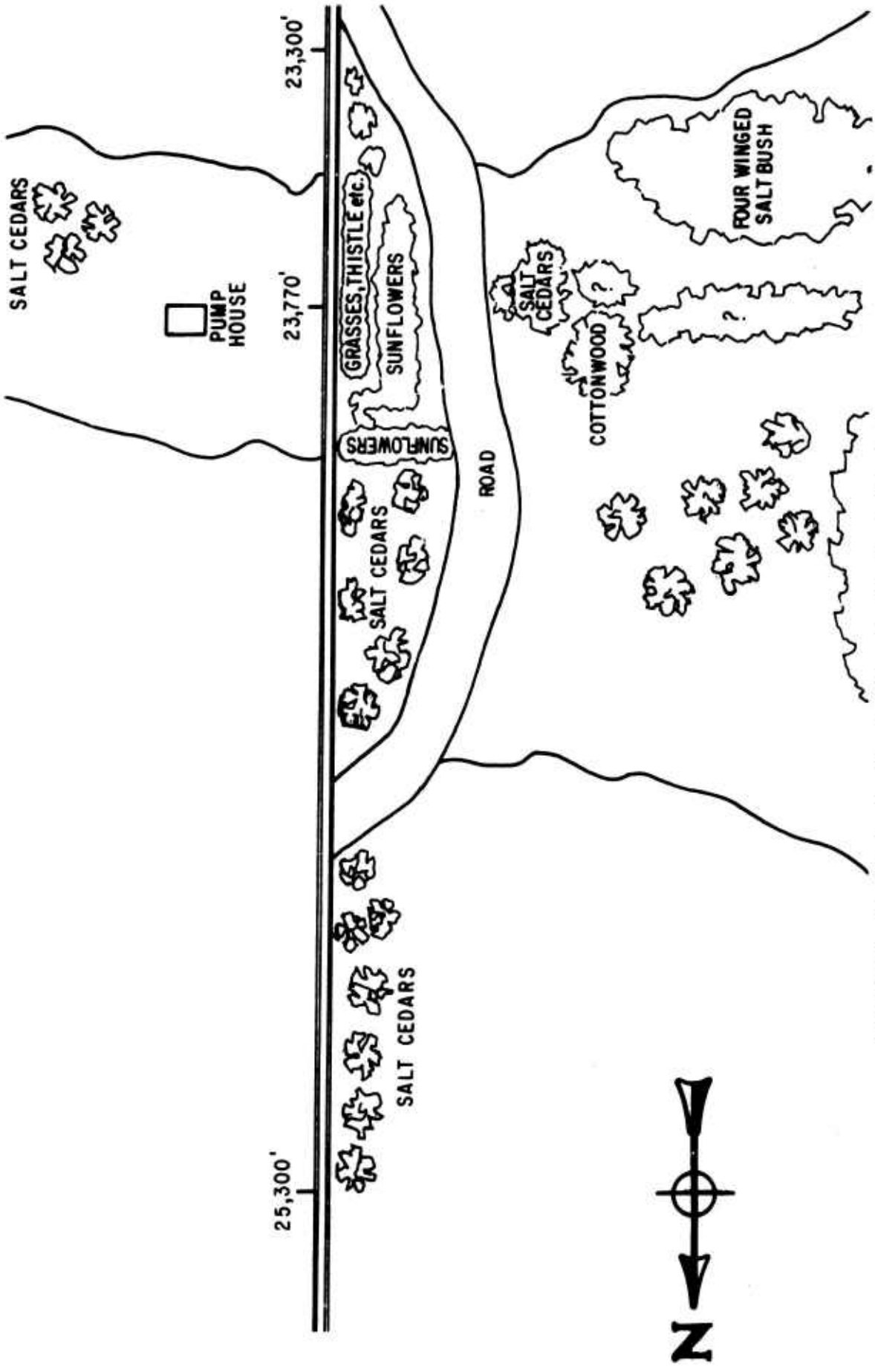

Figure 3. Predominate Vegetation in the Test Track Area

3. VEGETATION

The track is surrounded by vegetation common to the upper fringes of the Chihuahuan Desert. The most prevalent vegetation is four-winged salt bush (Atriplex canescens), snake weed (Gutierrezia lucida), paperflower (Psilo cooperi), long-leaf ephedra (Ephedra trifurca), and several species of sı flower (Helianthus spp.). Sunflower growth is particularly lush in Hay Dı west of the pump house where salt-cedars (Tamarix pentandra) and a few smal cottonwoods (Populus sp.) also occur.

The removal of vegetation used by birds for cover and food has been proposed by track personnel, but the high erosion coefficient of desert soil makes such a technique untenable. Even with present vegetation, certain sections of the track can be nearly covered by sand within a few hours. Snow fences have been positioned along the northwestern edge of the track to deter shifting sand.

SECTION III

TEST TRACK AVIFAUNA

1. TRACK SURVEY

Surveys of the test track avifauna were initiated on 23 January 1970 and continued until 22 April 1971. A total of 153 surveys were conducted during these 15 months. Although initial plans called for the surveys to end after 12 months, a 3-month extension was added to compare track area arrival times of spring migratory species for the 2 years (see figures 4 through 6 and table I).

2. MATERIALS AND METHODS

Surveys were conducted from the cab of a pickup truck driven at approximately 15 mph. From 20 to 30 minutes were required to make each survey. Stops were made as needed during the surveys for close-hand observation. The number of observers varied from one to four, with two being the usual number. Seventy percent of the surveys were made along the east side of the track traveling south to north; the remainder were made on the west side of the track traveling north to south. The track environs could be seen equally well regardless of which route was taken.

Birds perched on the track rails, between the rails, or on associated track structures (e.g., pipes and other hardware in the "rain erosion" area) were recorded as being "on the track." Birds within 30 yards of the track were recorded as being "in the track area." Binoculars and/or spotting scopes were used in all observations.

In the early stages of this study, help in bird identification was received from members of the Denver Wildlife Research Center. Birds that could not be positively identified were so listed.

3. RESULTS

Forty-one avian species were sighted in the test track vicinity (figure 4). The most abundant species was the house finch (Carpodacus mexicanus), 9377 of which were sighted during the 132 surveys. Other major species (in order of abundance) were horned larks (Eremophila alpestris), lark buntings (Calamospiza

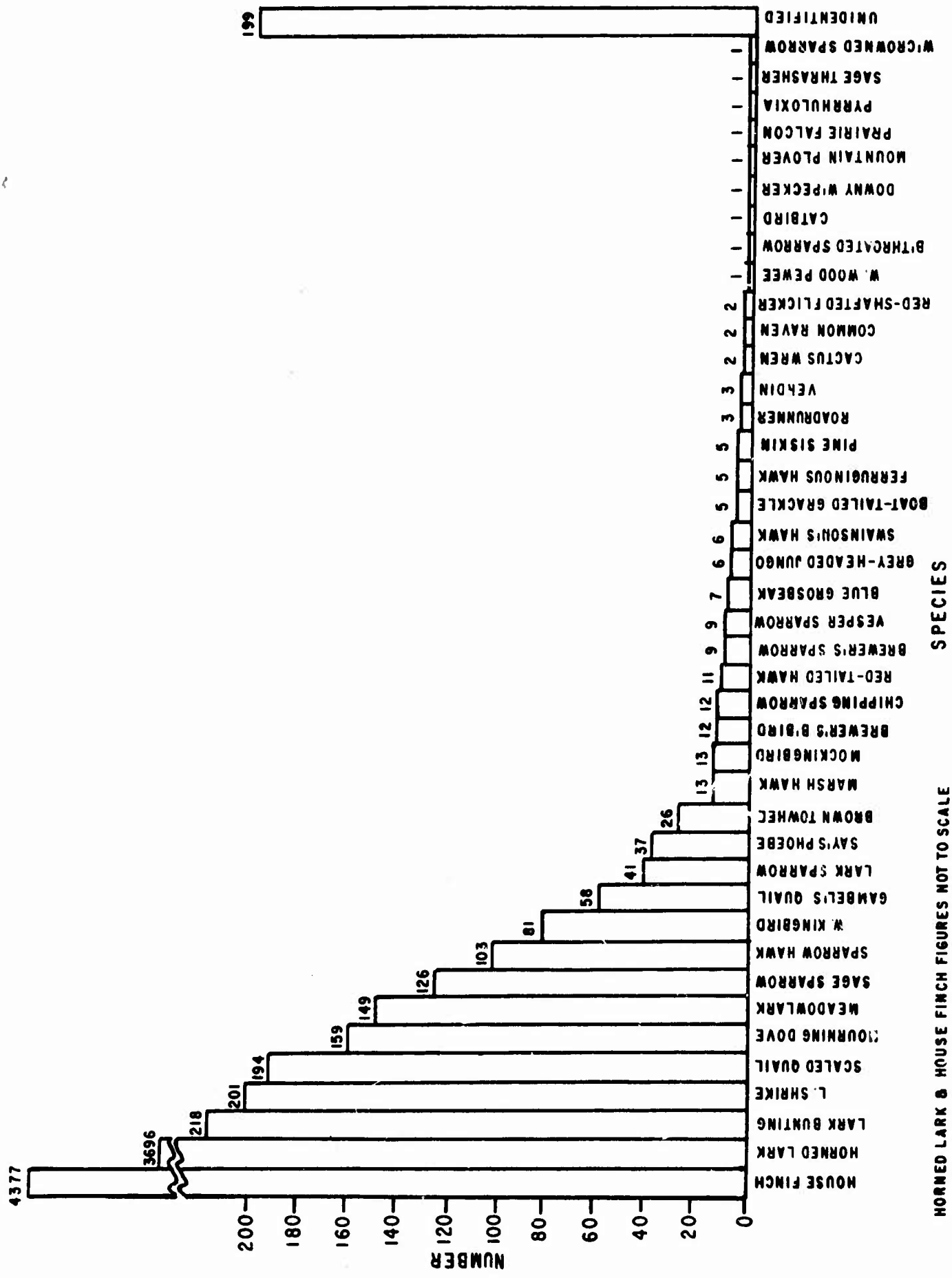

Figure 4. Population Analysis of Avifauna in the Test Track Vicinity

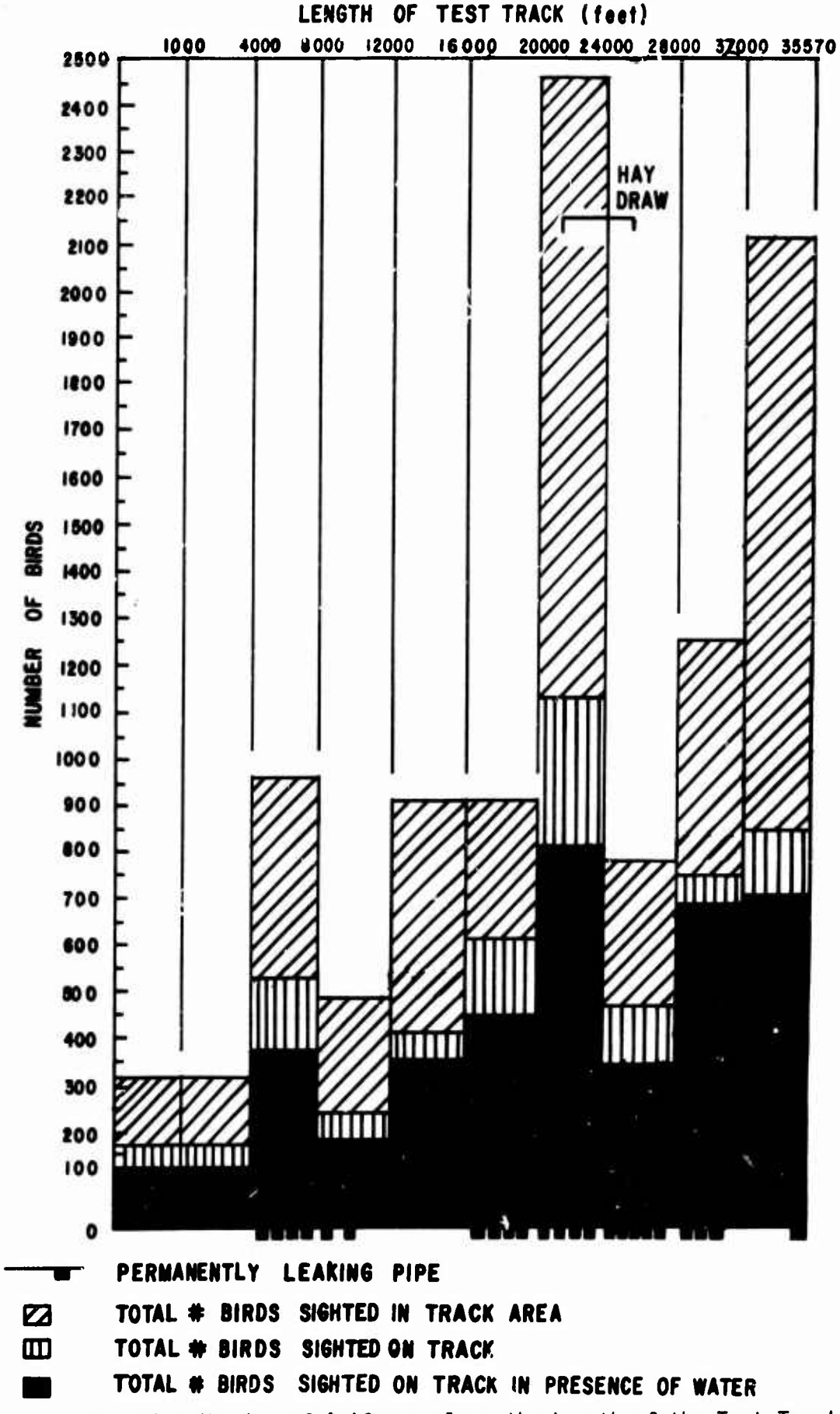

Figure 5. Distribution of Avifauna along the Length of the Test Track

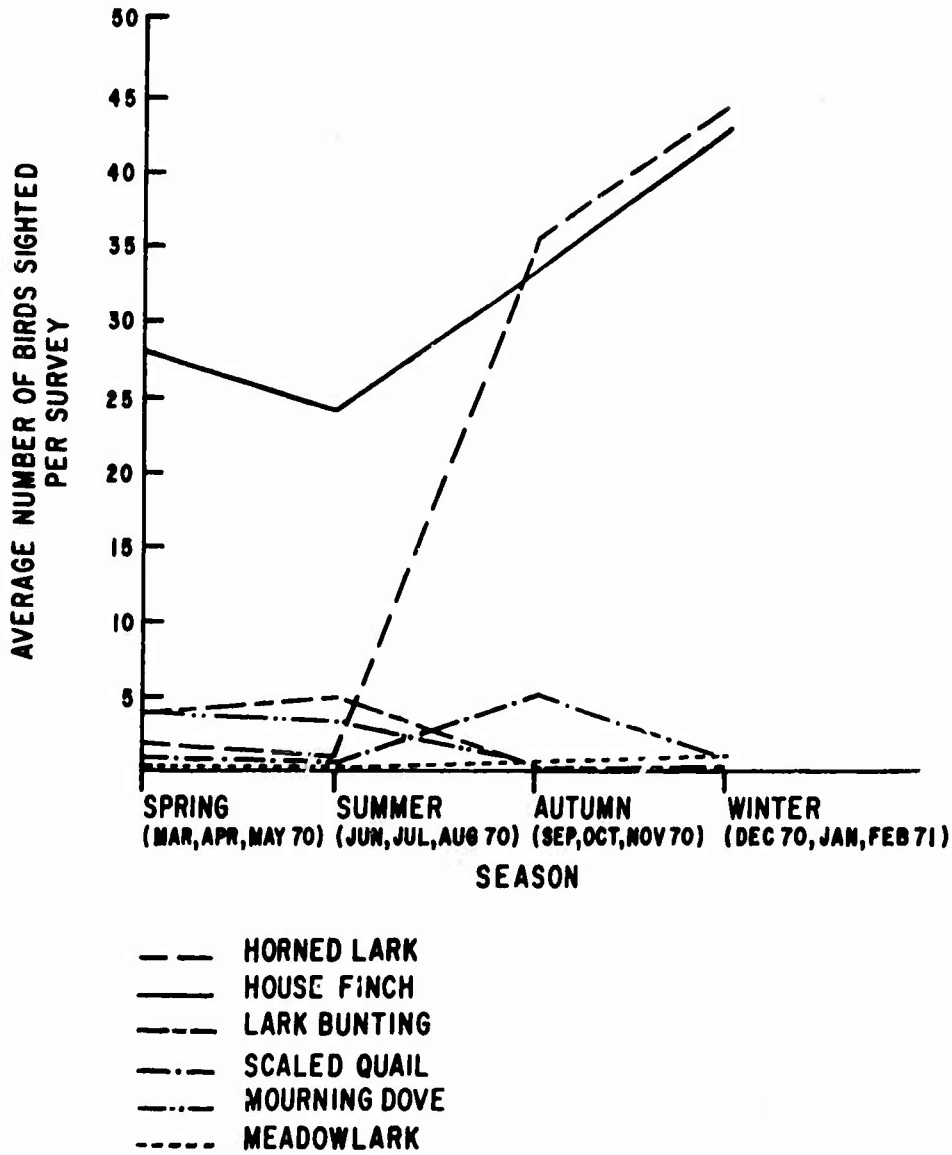

Figure 6. Seasonal Population Fluctuations in the Six Most Abundant Species in the Test Track Vicinity

Table I

NUMBERS OF HOUSE FINCHES OBSERVED AT 10-MINUTE INTERVALS DURING THE AV-ALARM TEST PERIOD
(30 January to 5 February 1971)

Time	Obser, birds, and average	Sat. 30 Jan	Sun. 31 Jan	Mon. 1 Feb	Tues. 2 Feb	Wed. 3 Feb	Thurs. 4 Feb	Fri. 5 Feb
A.M. 0700-1159	No. obser.	21	23	24	29	Track closed	25	18
	No. birds	108	209	91	63		24	12
	Ave. no. obser.	5.1	9.1	3.8	2.2		1.0	0.7
P.M. 1200-1730	No. obser.	18	No observations	23	14	Track closed	No water	13
	No. birds	133		64	15			32
	Ave. no. obser.	7.4		2.8	1.0			2.5
Day's totals	No. obser.	39	23	47	43	Track closed	2.5	31
	No. birds	241	209	155	78		24	44
	Ave. no. obser.	6.2	9.1	3.3	1.8		1.0	1.4

melanocorys), loggerhead shrikes (Lanius ludovicianus), scaled quail (Callipepla squamata), mourning doves (Zenaidura macroura), western meadowlarks (Sturnella neglecta), sage sparrows (Amphispiza belli), sparrow hawks (Falco sparverius), Western kingbirds (Tyrannus verticalis), and Gambels quail (Lophortyx gambelii). A total of 9799 birds were sighted; 199 of these were unidentified.

Bird abundance is greater during the autumn, due predominantly to an influx of migratory horned larks. During March, April, and May 1971, the average number of horned larks sighted per survey averaged slightly less than two. From June through August 1971, horned lark abundance steadily increased from less than two to 35 birds sighted per survey. In September 1971 the rate of increase in horned lark abundance began to plateau. In November a peak abundance of 44 birds per survey was reached. Though not as migratory as horned larks, house finches and scaled quail are also most abundant in the fall. Approximately 26 house finches per survey were sighted in March, April, and May 1971. By November 1971 this figure had increased to 44. Peak scaled quail abundance occurred in September when an average of 4.3 quail were sighted per survey.

Bird distribution was closely correlated with the locations of leaks in the pipes inside the track channel, which provide water for the braking system and artificial rain field. Along the first 4000 feet of track, in which no leaks were apparent, only 317 birds were sighted. In the vicinity of the next 4000 feet, in which four leaks were found, 961 birds were sighted. That portion of the braking channel intersecting Hay Draw (approximately 21,000 to 25,000 feet from the track's beginning) constantly contained a shallow water film due to nine pipeline leaks and the operation of the artificial rain field. Bird abundance was by far greatest in this area, averaging almost 2500 birds sighted per 1000 feet. Birds were also very abundant near the track's final 3500 feet where 2130 birds were noted.

SECTION IV

BIRD CONTROL TECHNIQUES

Phase II of this project involved the testing of several bird-control techniques along different sections of the 7-mile test track. Various control techniques were tested from April 1970 through July 1972.

1. MODIFIED AUSTRALIAN CROW TRAPS

Three Australian crow traps were set up west of the track during the late spring, summer, and fall of 1970. Each trap was baited with approximately 10 birds of varying species (house finches and several types of sparrows). On 20 October 1970, 12 house finches were trapped in less than 2 hours. Usually, however, capture rates were meager. The traps were regularly invaded by loggerhead shrikes (Lanius ludovicianus). On one occasion, two shrikes killed more than a dozen finches and sparrows in a single morning. Attempts to prevent shrike entry by controlling the size of entrance holes were unsuccessful, apparently due to the unwillingness of finches and sparrows to enter the smaller holes.

In addition, mammalian predators, including striped skunks (Mephitis mephitis), gray foxes (Urocyon cinereoargenteus), and possibly badgers (Taxidea taxis), and porcupines (Erethizon dorsatum) damaged the traps trying to reach the avian decoys. High winds also destroyed the traps on several different occasions. The trapping program was terminated in January 1972.

2. GROUND TRAPS

Twenty-three small ground traps were obtained on loan from the New Mexico State Game and Fish Department to test the effectiveness of ground trapping in controlling horned larks and quail. All traps were set up in December 1970 along the east side of the track in prime horned lark feeding areas. Corn and milo seeds were used as bait and were spread around and within the traps.

Following initial avoidance, horned larks gradually began to feed regularly near the traps. Over a 2-week period, more than 40 larks were observed feeding on corn and milo. Only 10 of these actually entered the traps.

In January 1971, seven of the ground traps were moved to Hay Draw west of the track to trap the two covies of quail that had frequently been seen there. Within 2 days, five Gambels quail and four scaled quail had been captured. The quail were transported to an area 27 miles south of Carrizozo, New Mexico, and released.

3. MIST NETS

Mist nets of varying lengths, colors, and mesh sizes were used throughout the trapping program to capture decoys for the ground and the Australian crow traps and to capture birds for positive identification. The nets proved to be most effective in Hay Draw immediately west of the track.

4. CANNON NETS

On 23 January 1971, 40 yards east of the track across from the 28,000-foot hash mark, an area approximately 60 by 30 feet was baited with milo, rape, and canary grass seed. The baited site was located in a low area ringed by a thick growth of grass and salt brush. Heavier cover--a grove of salt cedars--occurred 40 yards to the northeast. A regularly visited watering site existed between the tracks at about the 28,300-foot hash mark. This was the only available water source for approximately 2000 feet in either direction along the track.

On 4 February 1971, a cannon net (60 by 30 feet, fringeless, 1-inch mesh, launched by three "Dill" cannons) was set up at the baited site. Six horned larks were captured with the first firing of the cannons at 1415 hours. At 1130 hours on 5 February 1971, the cannon nets were again tested. One lark was netted. Equipment failure precluded further testing of the cannon net.

The horned larks were not frightened by the cannon net firings. It was noted that most of the larks returned to the baited areas immediately after discharge, and most birds inside the range of the net did not flush.

5. HABITAT MANIPULATION

A vegetational survey of Hay Draw was conducted in March 1971. Dense stands of sunflowers (Helianthus sp.) 30 feet west of the track at the 23,700-foot hash mark provided food for house finches, sage sparrows, and white-crowned sparrows (Zonatrichia leucophrys). Salt cedars and cottonwoods provided cover for mourning doves and other species.

Permission to apply selective herbicides was granted by the Chief of the Track Test Control Branch in April 1971. Herbicide application was limited to a small area in Hay Draw. The test area was selected on the basis of its slight soil erosion potential and its abundance of plants beneficial to birds.

"Paraquat," a water-soluble, pre-emergent herbicide was applied to sunflower and salt cedars on 8 April and again on 26 May 1971. Sunflower and salt cedar growth was curtailed, but dead salt cedar stems still served as bird cover.

6. BIOACOUSTICS

Bioacoustics, the use of prerecorded alarm vocalizations to elicit an escape response, was tested on horned larks and house finches. Mr. Gordon W. Boudreau, consultant for Air Force Weapons Laboratory, provided all the necessary equipment and was the principal investigator. The results of the bioacoustic test have been published in a separate report (AFWL Technical Note DE-TN-71-002). A summary of the results follows.

a. Horned Larks

When exposed to short bursts of sound (2 seconds or less in duration), birds were effectively dispersed, but often returned within 1 to 5 minutes. With longer exposures, the birds did not return for 15 to 30 minutes.

Flocks of five birds or more were always effectively dispersed by conspecific distress calls. Occasionally, groups of four or less failed to respond to initial projections, but usually did so on second or third applications or with an increase in sound intensity.

Only twice did bioacoustics fail to disperse solitary birds. The reasons for the temerity of these refractory individuals has not been determined.

Of the eight horned lark sounds tested, combinations of alarm notes, escape notes, alarm chirps, and distress sounds were most effective. None was effective when used alone. This suggests that horned larks usually confirm the acoustic stimuli with visual observations. When no predator is visible, the birds may not respond to single notes unless they are in a vulnerable situation, such as inside the water channel between the rails of the test track.

When exposed to combinations of distress vocalizations, their neural systems are doubly or triply stimulated, thus offsetting the absence of visual confirmation of the acoustic stimulus.

b. House Finches

In most instances, house finches responded instantly to the broadcasts when on or near the track. Response was particularly good if 5 or more minutes elapsed between broadcasts. The finches usually flew to the elevated wires paralleling the track, where they could be evicted by subsequent projections.

As with the horned larks, large flocks of house finches responded much more readily than solitary individuals. Occasionally groups of three or less completely ignored the broadcasts, especially if they were perched on wires.

7. AV-ALARM

On 30 January 1971, a 7-day test was begun to evaluate the effectiveness of a commercial device (Av-Alarm*), which mechanically simulates avian vocalizations, in excluding house finches from a regularly visited watering site at the extreme north end of the test track.

Over the 7-day test period, the initial flock of approximately 75 birds that regularly visited the site decreased to occasional visits by solitary birds and small flocks. A small increase in number of birds visiting the test area on the last day of the test is attributed to the drying up of a nearby water site.

8. ARTIFICIAL WATER SOURCES

Because water is the primary environmental parameter influencing the distribution of birds in the test track area, five artificial water sources were established approximately 500 feet east of the track to draw birds away from the track water channel. The waterers were established at 1500-foot intervals beginning at 20,754 feet from the beginning of the track and extending to the 26,754-foot hash mark. Watering sites were positioned in Hay Draw and in the more arid adjacent areas.

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*Reference to a commercial product should not be construed as an endorsement by the Air Force.

The artificial watering sites were constructed as follows. A spigot with 1/4-inch inside diameter was screwed into the lower part of an 80-gallon polyethylene carboy about 2 inches from the bottom. The carboy was placed on top of a 55-gallon oil drum and was filled with water from a mobile 300-gallon pumping unit. Square aluminum pans measuring 6 by 4 feet by 6 inches were placed on the ground beneath the spigot and were filled with 1-1/2 inches of water. The spigot was then adjusted to drip water from the carboy into the pan at a rate commensurate with evaporation (approximately one drop every 2 minutes). Two perching wires were installed above each tray. Wooden floats were placed in the trays to provide perches for the birds while drinking. The carboy must be periodically refilled and the spigots checked for mineral deposits in the orifice.

Observed bird activity at the waterers was greatest in Hay Draw, presumably because of the greater abundance of birds in this area before artificial water source installation. House finches, mourning doves, and horned larks readily accepted the waterers, as indicated by bird counts and a high incidence of fecal dropping in and around the trays. Through a program of harassment of water-seeking birds on the test track with bioacoustics or some other dispersal technique, birds may adopt the carboy waterers as their preferred water source. If sufficient birds can be drawn away from the test track by the carboy watering system, the bird-rocket sled collision hazard will be greatly reduced.

SECTION V

RECOMMENDATIONS

1. Because water is the main environmental parameter affecting bird incidence near the test track, it is extremely important that all leaks in the test track braking system be repaired. By denying them a source of water, the bird populations at the test track would be dramatically curtailed.

2. Probably the only species that could be significantly reduced through ground trapping is quail. A systematic and intensive quail trapping program could capture the three or four covies in the test track area. Captured birds should be removed to an alternate habitat in conjunction with the New Mexico Game and Fish Department.

3. Attempts to trap horned larks and house finches indicated that these species can be readily lured away from the track by alternate food sources. Areas baited with highly desirable lark and finch food (canary grass seeds, rape seed, etc.) several hundred yards away from the test track could be effective in reducing both populations near the track.

4. Mist nets set up near the track adjacent to areas of perpetual leakage would snare birds before they have a chance to perch on the rails and become a hazard.

5. The growth of the sunflowers in the Hay Draw area should be curtailed. If elimination of sunflowers will enhance soil erosion, areas currently occupied by sunflowers should be reseeded with grasses that provide little food or cover to hazardous birds.

6. Bioacoustics or mechanically reproduced alarm vocalizations (i.e., Av-Alarm) may effectively disperse the bulk of the horned larks and house finches just before sled launchings. Alarm vocalizations should be used only before a launch because birds will habituate to frequent or prolonged exposures.

7. Artificial watering sites established several hundred feet from the test track are effective in attracting birds. They will be especially effective if established near alternate feeding sites (recommendation 3).